WHAT IS CLAIMED IS:

1. A railroad hopper car discharge gate assembly, comprising:

a rigid frame configured with a generally rectangular discharge opening greater than 1600 square inches whereby allowing for rapid discharge of commodity therethrough, with a gate having a surface area generally equivalent to the size of the discharge opening and being mounted on said frame for generally linear movements between a closed position, wherein said gate prevents flow of commodity through said discharge opening and, and an open position, and wherein said frame is further configured to inhibit bending of said frame and said door under columnar loading adapted to be applied to the greater than 1600 square inches of surface area defined by said gate and which is exposed to commodity carried by a railcar to which said gate assembly is adapted to be operably coupled;

an operating shaft assembly supported by opposed frame extensions for rotation about a fixed axis, with said operating shaft assembly being operably coupled to said gate; and

a lock assembly operable in timed relation relative to rotation of said operating shaft assembly, said lock assembly including a stop which, when said gate is the closed position, positively engages with the gate thereby preventing inadvertent movement of said gate toward the open position and which is operably removed from the path of movement of the gate prior to said gate being positively moved under the influence of said operating shaft assembly moved toward the open position.

2. The railroad hopper car discharge gate assembly according to Claim 1 further including seal structure carried by said frame in relation relative to a peripheral edge of said gate.

3. The railroad hopper car discharge gate assembly according to Claim 1 wherein said frame includes a plurality of laterally spaced support members arranged in generally parallel relation relative to the direction in which said gate moves between the open and closed positions for limiting deflection of said gate and increasing stiffness of said frame.

4. The railroad hopper car discharge gate assembly according to Claim 3 wherein each of said support members is provided with material for enhancing the ability of the gate to slide thereover as said gate moves between the closed and open positions.

5. The railroad hopper car discharge gate assembly according to Claim 1 wherein said operating shaft assembly is operably coupled to said gate through pinions mounted on a shaft rotatable about said fixed axis, with said pinions being arranged in intermeshing relation with racks carried by said gate.

6. The railroad hopper car discharge gate assembly according to Claim 5 wherein said frame further includes structure for limiting deflection of the shaft of said operating shaft assembly relative to said fixed axis when said shaft is rotated to move said gate toward the open position.

7. The railroad hopper car discharge gate assembly according to Claim 1 wherein the stop of said lock assembly is urged into releasable engagement with said gate.

8. The railroad hopper car discharge gate assembly according to Claim 1 wherein a

mechanical system is provided between the stop of said lock assembly and said operating shaft assembly for positively displacing said stop from engagement with said gate upon rotation of said operating shaft assembly and prior to movement of said gate toward the open position.

9. The railroad hopper car discharge gate assembly according to Claim 8 further including a lost motion mechanism which collapses upon rotation of the operating shaft assembly in a direction to move the gate toward the open position whereafter said operating shaft assembly is operably coupled to said gate.

10. A railroad hopper car discharge gate assembly, comprising:

a frame including a pair of spaced, generally parallel side frame members and a pair of spaced, generally parallel end frame members fixed between said side frame members to define a ledgeless discharge outlet for said gate assembly;

a gate adapted for sliding endwise movements along a predetermined path of travel between closed and open positions, with said gate including upper and lower generally parallel surfaces;

and wherein, in an area surrounding peripheral edges of said gate, said side frame members and said end frame members each have a first leg portion and a second apertured leg portion extending in generally normal relation away from said first leg portion, with the spacing between the first leg portions of said side frame members and said end frame members being such that the ledgeless discharge outlet for said gate assembly ranges in size between about 1400 and about 1760 square inches, with said frame further including laterally spaced support members

disposed generally parallel to said side frame members and between said end frame members in sliding engagement with the lower surface of and for supporting the gate in the closed position against columnar load adapted to be exerted against the upper surface of said gate, and wherein said side frame members, said end frame members, and said support members are configured to withstand columnar loading adapted to be applied the upper surface of said gate, corresponding in cross-sectional size to the cross-sectional area of said discharge opening, and wherein said side frame members extend away from the discharge outlet for said gate assembly and are configured to support said gate when said gate is moved to an open position;

an operating shaft assembly carried by said side frame members for rotational movement about a fixed axis, said operating shaft assembly being operably coupled to said gate; and

a lock assembly including a displacable stop operable in timed relation relative to rotation of said operating shaft assembly for preventing inadvertent movement of said gate toward the open position and which is operably removed from the path of movement of the gate prior to said gate being positively moved under the influence of said operating shaft assembly moved toward the open position.

11. The railroad hopper car discharge gate assembly according to Claim 10 further including seal structure carried by said frame relative to a peripheral edge of said gate.

12. The railroad hopper car discharge gate assembly according to Claim 10 wherein said support members include a first support member extending generally along a longitudinal centerline of said gate assembly along with second and third support members disposed to

opposite lateral sides of the longitudinal centerline of said gate assembly.

13. The railroad hopper car discharge gate assembly according to Claim 12 wherein each support member is provided with material for enhancing the ability of the gate to slide thereover as said gate moves between the closed and open positions.

14. The railroad hopper car discharge gate assembly according to Claim 10 wherein said operating shaft assembly is operably coupled to said gate through pinions mounted on a shaft rotatable about said fixed axis, with said pinions being arranged in intermeshing relation with racks mounted on the lower surface of said gate.

15. The railroad hopper car discharge gate assembly according to Claim 14 wherein said operating shaft extends transversely across the predetermined path of travel of said gate and includes capstans arranged at opposite ends thereof, said capstans being disposed for engagement form either side of said gate assembly.

16. The railroad hopper car discharge gate assembly according to Claim 15 wherein said frame further includes structure arranged along the length of said operating shaft for minimizing the effect high torque requirements inputted to said operating shaft assembly have on operation of said gate assembly.

17. The railroad hopper car discharge gate assembly according to Claim 10 wherein said lock

assembly further includes a mechanical system carried by said side frame members for positively displacing said stop in timed relation relative to operation of said operating shaft assembly.

18. The railroad hopper car discharge gate assembly according to Claim 17 wherein said mechanical system includes cam structure disposed adjacent to the side frame members to minimize the effect high torque requirements inputted to said operating shaft assembly have on operation of said lock assembly.

19. The railroad hopper car discharge gate assembly according to Claim 18 wherein each side frame member and said end frame member further includes a third leg portion extending in generally normal relation away from said first leg portion, with said third leg portion being spaced from but extending in the same direction as and in generally parallel relation with said second leg portion to add strength and rigidity to said frame.

20. The railroad hopper car discharge gate assembly according to Claim 19 wherein a peripheral edge of said cam structure on said operating shaft assembly traverses a path of rotation confined within the spacing provided between said second and third leg portions of each side frame member.

21. The railroad hopper car discharge gate assembly according to Claim 19 wherein a distance of about 9.0 inches is measurable between the said second and third leg portions of each side frame member and each end frame member.

22. The railroad hopper car discharge gate assembly according to Claim 19 wherein the third leg portion of the side frame and end frame members of said frame are arranged generally coplanar relative to each other.

23. The railroad hopper car discharge gate assembly according to Claim 17 further including a lost motion mechanism operably disposed between said operating shaft assembly and the mechanical system for said lock assembly for effecting sequential movement of the stop and said gate in predetermined relation relative to each other.

24. The railroad hopper car discharge gate assembly according to Claim 23 wherein said stop is mounted on and movable with a rockshaft extending parallel to and above said gate, said rockshaft having at least one follower toward one end thereof for engaging a periphery of a cam arranged toward a corresponding end of said operating shaft assembly thereby positively moving said stop regardless of the torque input to said operating shaft assembly.

25. The railroad hopper car discharge gate assembly according to Claim 10 wherein a tamper seal arrangement is arranged in combination with said operating shaft assembly for accepting a seal for visually indicating whether said gate has been moved toward the open position.

26. A gate assembly adapted to be secured in material receiving relation relative to a standard opening defined toward a bottom of a railroad hopper car, said gate assembly comprising:

a rigid frame having a longitudinal axis and including a series of side frame members and

end frame members which are spaced relative to each other and configured to provide said frame with a ledgeless and generally rectangular discharge opening sized substantially equivalent to the standard opening defined toward the bottom of the railroad hopper car whereby allowing commodity discharged from the opening in the bottom of the railcar to pass through said gate assembly in a substantially unhindered fashion thereby promoting the discharge of commodity from the railcar, with said side frame members and said end frame members defining a bolting pattern generally corresponding to a standard bolting pattern surrounding the standard opening toward the bottom of the railroad hopper car whereby facilitating securement of the gate assembly to the railroad hopper car, and wherein said ledgeless frame further includes a generally centralized support extending generally parallel to the longitudinal axis of said frame with two additional supports disposed to opposed sides of said centralized support;

a gate slidably mounted for endwise movements between open and closed positions relative to said ledgeless opening defined by said frame and along a generally linear path of movement for controlling discharge of commodity through said ledgeless opening, with said gate being supported by said supports when in the closed position and supported by said frame when moved to the open position;

an operating shaft assembly mounted on frame extension of said side frame members for rotation about a fixed axis, said operating shaft assembly defining a pair of opposed ends disposed for operator access from opposite sides of said frame;

a drive mechanism for operably coupling said operating shaft assembly to the gate whereby rotation of said operating shaft assembly linearly moves said gate between the open and closed positions, with said drive mechanism including a lost motion mechanism operably disposed

between said operating shaft assembly and said gate for allowing a predetermined range of free rotation of said operating shaft assembly prior to movement of said gate toward the open position; and

a lock assembly operably connected to said operating shaft and operable in timed relation relative to movement of said gate toward the open position, said lock assembly including a stop mounted for movement between a first position, wherein said stop is disposed in the path of movement of said gate whereby inhibiting inadvertent movement of the gate from the closed position toward the open position, and a second position, wherein said stop is removed from the path of movement of the gate, with said stop being movable from said first position to said second position during the collapse of the lost motion mechanism of said drive mechanism.

27. The gate assembly according to Claim 26 wherein each support on said frame is provided with material for enhancing the ability of the gate to slide thereover as said gate moves between the closed and open positions.

28. The gate assembly according to Claim 26 further including seal structure carried by said frame relative to a periphery of said gate when said gate is the closed position.

29. The gate assembly according to Claim 26 wherein said drive mechanism includes a pair of laterally spaced pinions mounted on a shaft of said operating shaft assembly, with said pinions being arranged in intermeshing relation with racks carried by said gate.

30. The gate assembly according to Claim 29 wherein said lost motion mechanism of said drive mechanism comprises a slip socket defined by each of said laterally spaced pinions.

31. The gate assembly according to Claim 26 wherein said frame further includes structure for limiting deflection of said shaft of said shaft assembly relative to said fixed axis when said operating shaft assembly is rotated to move said gate from the closed to the open position.

32. The gate assembly according to Claim 26 wherein said lock assembly further includes a a mechanical system carried by said side frame members for positively displacing said stop in timed relation relative to movement of said gate toward the open position.

33. The gate assembly according to Claim 32 wherein said mechanical system includes structure disposed adjacent to the side frame members to minimize the effect high torque requirements of said operating shaft assembly have on operation of said mechanical system.

34. The gate assembly according to Claim 33 wherein said operating shaft assembly includes an elongated shaft supported for rotation about said fixed axis by a pair of operating handles secured at opposite ends of said shaft and rotatably mounted on the frame of said gate assembly.

35. The gate assembly according to Claim 34 wherein at least one of said operating handles includes a cam arranged for rotation therewith, and wherein the mechanical system of said lock assembly further includes a rockshaft supported by frame extensions, with said rockshaft having

said stop mounted thereon for rotation therewith, and wherein said mechanical system further includes a follower secured to said rockshaft and arranged in operable engagement with the cam on said at least one of said operating handles whereby said stop is moved between positions in response to rotation of the operating shaft assembly.

36. The gate assembly according to Claim 35 wherein each side frame member and said end frame member includes a first leg portion with second and third leg portions extending generally normal thereto and toward opposite ends thereof such that each end frame member and side frame member is configured to maximize the section modulus of said frame, and wherein the second leg portion of each end frame member and side frame member defines a series of apertures defining the bolting pattern for said gate assembly.

37. The gate assembly according to Claim 36 wherein a peripheral edge of said cam of said mechanical system traverses a path of rotation confined within the spacing provided between said second and third leg portions of each side frame member.

38. The gate assembly according to Claim 36 wherein the third leg portions of the side frame and end frame members of said frame are arranged generally coplanar relative to each other.

39. The gate assembly according to Claim 26 wherein a tamper seal arrangement is provided in combination with said operating shaft assembly for accepting a seal for visually indicating whether said gate has been moved toward the open position.